

REMARKS

The Examiner has objected to the drawings, believing some drawings require a "Prior Art" designation. The Examiner has rejected claims 1-23 under 35 U.S.C. sec 112 as indefinite due to elements undefined in the specification. The Examiner has rejected claims 1-3, 5, 7-9, 11, 13-19, and 23 under 35 U.S.C. sec 102(e) as anticipated by Stoltze et al. (U.S. Patent No. 6,246,711). The Examiner has rejected claims 4, 6, 10, 12, and 20-22 under 35 U.S.C. sec 103(a) as obvious over the '711 patent. Applicant respectfully traverses these rejections with argument and amendment and requests these rejections be withdrawn.

**DRAWINGS**

The Examiner has objected to the drawings under belief that one or more of the drawings should be labeled "Prior Art". After reviewing the drawings, Applicant has determined only Figure 5 depicts the claimed invention. Figures 1 and 4 are repetitious and representative of the upconversion problem in Yttrium-Erbium glass lasers (such as the one in cited U.S. Patent 6,246,711) and, as such, Applicant proposes amending the drawings with the "Prior Art" legend. Similarly, Figure 3 is illustrative of Tm-Ho:YAG laser systems, which are not the subject of the present invention and, for that reason, Applicant would propose amending the drawings with the "Prior Art" legend.

The Figure 2 drawings are irrelevant to the claimed invention and should be deleted. Also, please delete the third paragraph of the BRIEF DESCRIPTION OF THE DRAWINGS, which begins "FIGURE 2 depicts ..." and please delete the first paragraph on page 9 as these paragraphs reference Figure 2 and are also unnecessary to the

invention disclosure. Applicant believes the above requested amendments resolve the Examiner's drawings objection.

### 35 USC 112

The Examiner has rejected claims 1-23 under 35 U.S.C. sec 112 as indefinite due to elements undefined in the specification. Applicant asserts that gain medium, resonant cavity, reflectors/mirrors, Q-Switch, lenses, and optical fiber are common terms to those skilled in the laser art. Furthermore, as amended, only the Q-Switch term appears in the claims. A Q-Switch or Q-Switched resonator is a device in which a host is placed. Normally, when ions doped in a host are excited, such as by pump light, the excitation energy is immediately released. This mode of operation is standard for a continuous wave laser. A Q-Switch is essentially an on-off switch to control the release of the energy. Of course, as described in the specification, if the excited ions do not release their energy relatively quickly, the energy from the excited state will dissipate through relaxation or upconversion. Again, this information is common knowledge to one skilled in the art.

Regarding claims 1 and 7, the phrase "being in band to  $I^2$  devices" has been removed from the claim language. An  $I^2$  device is an image intensifier as disclosed in the BACKGROUND. With regards to the rejections of claims 7, 10, 13, 14, and 19 for Sec. 112 issues, the claims have been withdrawn. Applicant therefore requests, based on the above-stated amendments, the Examiner withdraw the rejection based on Sec. 112.

### 35 USC 102

Claims 1-3, 5, 7-9, 11, 13-19, and 23 were rejected by the Examiner under Sec. 102(e) as being anticipated by Stultz et al. (U.S. Patent No. 6,246,711). Claim 1 has been amended to contain a limitation originally found in claim 4, which the Examiner determined was not anticipated by Stultz et al. Therefore, claim 1, as well as claims 2, 3, and 5, which are dependent on claim 1, have overcome the anticipation rejection by amendment. Claims 7-9, 11, 13-17, and 19 have been withdrawn. Therefore, of the claims found by the Examiner to be anticipated, only the rejection of claims 18 and 23 merits discussion.

Claim 18 has also been amended to overcome the anticipation rejection. The Examiner determined claim 18 was amended because Stultz taught a resonant pumped erbium laser comprising an erbium concentration of less than 2%. Stultz taught an erbium concentration of 0.5%. Applicant herein amends claim 18 to an erbium concentration of between approximately 1% and approximately 2%. As a concentration of 0.5% is not between approximately 1% and approximately 2%, Stultz no longer teaches every limitation of the claimed invention.

Claim 23 is not anticipated by Stultz. The Examiner points to Col. 3, lines 50-53 for teaching a the first excited state of Erbium is pumped at approximately 1.5 microns. Stultz does not teach this limitation. The passage identified by the Examiner is an explanation of the Erbium upconversion existing in the disclosed prior art, not pumping. Further, if the anticipation rejection for claim 18, upon which claim 23 depends, is withdrawn, then the anticipation rejection to claim 23 should also be withdrawn. Applicant respectfully requests the Examiner withdraw the anticipation rejection with regard to remaining claims 1-3, 5, 18, and 23.

## 35 USC 103(a)

Applicant understands the obligation under 37 CFR 1.56.

Claims 4, 6, 10, 12, 20-22 were rejected under 35 U.S.C. 103 as being obvious in light of Stultz. By amendment, claim 1 was modified to contain the limitations of claim 4 and claims 4, 10 and 12 were withdrawn. As claims 2, 3, 5, and 6 depend on claim 1, as a result of the amendment provided herein, Applicant is treating claims 1-3, 5, 6, and 20-22 as subject to the obviousness rejection.

Claim 1 contains two limitations that were neither taught nor suggested by Stultz. First, Stultz did not teach or suggest a storage lifetime of at least 4msec. Stultz teaches a storage lifetime of 29nsec (Col. 4, line 21). Furthermore, Stultz cannot teach a storage lifetime of 4msec. because the excited Erbium will substantially dissipate well before 4msec. in the structure taught, through relaxation and upconversion, as taught in Applicant's specification. Second, Stultz did not teach or suggest an output of 250mJ to 300mJ. Stultz taught a 25W pump source generating 0.4mJ laser output. If the efficiency of the system were constant, a 1.75KW pump would be needed to generate 280mJ. There is no teaching or reason to believe the Stultz laser could handle this size input or that it would operate with the same efficiencies at a larger scale. The examiner mentions that specific output is dependent upon gain material and pumping energy, but nothing taught in Stultz would lead one to generate a 250mJ laser. As the cited reference does not teach the claimed invention, the Applicant respectfully requests the Examiner withdraw the obviousness rejection.

Claim 2 is not obvious in view of Stultz. On top of the reasons claim 1 is not obvious, which are also applicable to claim 2, Stultz does not teach a concentration of Erbium ions between 1% and 2% or a storage lifetime of 10msec. Furthermore, the invention disclosed by Stultz is incapable of adopting these limitations. Doubling, tripling or quadrupling the Erbium concentration taught in Stultz would cause substantial upconversion problems. For the same upconversion problems, Stultz cannot sustain a storage lifetime of 10msec. As Stultz neither teaches, nor suggests, nor is capable of these limitations, Applicant respectfully requests the Examiner withdraw this rejection.

Claims 3 and 5 are not obvious as both claims are dependent on a nonobvious claim. Applicant respectfully requests the Examiner withdraw this rejection.

Claim 6 is nonobvious for all of the reasons explained with regards to claim 1 and further in regards to the gain issues presented. Claim 1 limits the laser output to 250mJ to 300mJ. Claim 6 contains that limitation plus the limitation of a pump source of 30-60W. That is an efficiency of about 4-10 mJ/W. Stultz taught an output of 0.4mJ and a source of 25W (col. 4 line 2). Therefore, Stultz teaches an efficiency of 0.16 mJ/W. The Applicant's invention achieves a high efficiency that Stultz cannot. This efficiency provides the claimed invention with the ability to be a high gain amplifier at the 1.5 micron (telecommunications) wavelength. As the cited reference does not teach the claimed limitations and the claimed limitations are not obvious in light of the cited reference, Applicant respectfully requests the Examiner withdraw the rejection.

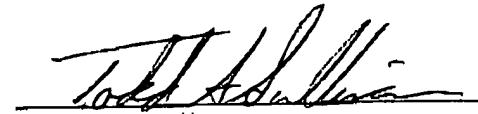
Claims 20-22 contain limitations discussed herein. All three claims are dependent on claim 18. Claim 18 contains limitations neither taught nor suggested by Stultz. The limitations of claims 20-22, dependent on an amended claim 18, contain limitations

neither taught nor suggested by Stultz, for reasons already discussed. Applicant respectfully requests the Examiner withdraw the rejection of claims 20-22.

## CONCLUSION

For all of the above reasons, the applicant submits that the amendments made herein put application in position for allowance. The fees associated with this amendment, if any are due, are included herewith.

Respectfully submitted,



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## CLAIM AMENDMENTS

1. (Amended) An eyesafe, Q-switched, laser system [for target verification, ranging, and gated viewing, said laser system] having a number of diodes for optical pumping, said system comprising:

a resonant pumped erbium [(RPE)] laser having a storage lifetime of at least 4msec [that minimizes] thereby minimizing said number of diodes needed to pump said [Er] laser [, said RPE laser being in band to I<sup>2</sup> devices]; and

an energy/pulse between approximately 250mJ and approximately 300mJ.

2. (Amended) The [eyesafe, Q-switched, laser] system in accordance with claim 1, further comprising dilute concentrations of unsensitized Erbium in an approximate range of between [0.1] 1% and 2% of active ion, said Erbium [and] having [a] the storage lifetime of approximately [~]10msec for a 1.5 micron transition.

3. (Amended) The [eyesafe, Q-switched, laser] system in accordance with claim 2 further comprising [an Erbium] a crystalline [or glass] host for the Erbium [pumped by 1.5 micron diodes or diode pumped Yb-Er glass lasers].

4. (Withdrawn)

5. (Amended) The [eyesafe, Q-switched, laser] system in accordance with claim 1, wherein [said Erbium] the laser [further comprises] has a wavelength of approximately [~]1.5 microns.

6. (Amended) The [eyesafe, Q-switched, laser] system in accordance with claim [2,] 1 wherein said number of diodes pump [~] approximately 30 to 60W at 1.5 microns wavelength for [~] approximately 10msec.

7. (Withdrawn)

8. (Withdrawn)

9. (Withdrawn)

10. (Withdrawn)

11. (Withdrawn)

12. (Withdrawn)

13. (Withdrawn)

14. (Withdrawn)

15. (Withdrawn)

16. (Withdrawn)

17. (Withdrawn)

18. (Amended) A high-energy, eye-safe Q-switched laser comprising:  
a Resonant Pumped Erbium laser with dilute concentrations of unsensitized  
Erbium wherein the unsensitized Erbium concentration is [below] between about 1%  
about 2%.

19. (Withdrawn).

20. (Original) The laser of claim 18 further comprising an Erbium:Yttrium Lithium  
Fluoride oscillator pumped by the Erbium laser.

21. (Original) The laser of claim 18 further comprising an energy/pulse between  
approximately 250 and 300mJ.

22. (Original) The laser of claim 18 further comprising a plurality of diodes pumping  
approximately 30 to 60W at about 1.5 microns wavelength, for approximately 10 ms.

23. (Original) The laser of claim 18 wherein the first excited state of Erbium is pumped  
at approximately 1.5 microns.

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